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TECHNICAL FIELD

The present invention relates to a method and an apparatus for providing efficient radio based communication for subscribers located in a transportation vehicle or the like, such as in an aeroplane. In particular the invention relates to a method and an apparatus for reducing signalling between subscribers in a vehicle or a craft, in particular a fast moving vehicle or craft, and a radio system.

BACKGROUND OF THE INVENTION AND PRIOR ART

In aeroplanes it is often forbidden to use GSM-telephones and other cellular telephones. Instead, satellite telephones are used. One system for satellite telephony is the ICO satellite system. In such a system location areas corresponding to cells in a mobile telephone network are provided.

Furthermore, it is desired by the subscribers to cellular telephones to be able to use them onboard aeroplanes and the like. In WO 9428684 a system enabling the use of telephones on-board is described. According to WO 9428684, mobile telephones on-board an aeroplane or a ship are connected to an on-board system via wires or an infra-red (IR) transmitter/receiver system. The onboard system then communicates over a wireless interface with the surrounding world using a TFTS (Terrestrial Flight Telephony System) based communication link.

However, one problem, which will occur if a system as described in WO 9428684 is used inside an aeroplane or in another vehicle travelling at high speed is that the update of location would occur very often, and that many update messages would be transmitted simultaneously, since a modern aeroplane can transport many passengers. Thus, a potential overload of location update signalling traffic will occur.

SUMMARY

It is an object of the present invention to overcome the problems as outlined above and to provide a method and a system having improved functions for handling traffic from cellular telephones in aeroplanes and similar locations.

This object and others are obtained by a method and an apparatus wherein a subscriber to a cellular telephone entering an area with restricted use of cellular telephones attaches and registers the cellular telephone in a terminal located in the restricted area. The terminal provides a connection to a satellite system, for example the ICO satellite system.

When the subscriber is registered in the terminal, the terminal transmits a location update message indicating to the satellite system that the subscriber now is registered in the terminal. When another, second, subscriber enters the area, the second subscriber is also registered in the terminal and so on.

Thus, each time a new subscriber connects to the terminal a location update message is transmitted to the satellite system. The information is stored in the satellite system until a subscriber leaves the area covered by the terminal. A message is then transmitted from the terminal to the satellite system informing the satellite system that the subscriber is no longer connected to the terminal and the subscriber is detached from the satellite system.

When the terminal roams in the satellite network it will send a location update only comprising its own identity. The satellite network then implicitly updates the location of all

cellular telephone subscribers registered in or attached to the terminal, using the information of which mobile stations that currently are attached to the terminal.

Thus the terminal only has to transmit one single message for all mobile stations connected to it in order to update the location of all the mobile stations. Thus, the amount of air-interface signalling, signalling towards the VLRs and towards the HLRs (Home location Register) will be significantly reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described in more detail and with reference to the accompanying drawings, in which:

- Fig. 1 is a general view of a radio communication system.
- Fig. 2 is a flow chart illustrating different steps performed when attaching a mobile telephone to the system shown in Fig. 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

In Fig. 1, a general view of a telecommunication system is shown. The system comprises a satellite network 101, in the embodiment shown in Fig. 1 a satellite system, which in turn can be connected to a GSM system (not shown), a multi-channel terminal (MCT) 103 located inside an aeroplane 105 and mobile stations (MS) 107.

The multi-channel terminal 103 is an apparatus to which mobile stations can be attached, for example using a wireline connection, an Infrared (IR) connection or a Bluetooth™ connection. In the exemplary embodiment shown in Fig. 1, the terminal 103 is mounted in an aeroplane 105 for enabling

telecommunication between the mobile stations 107 and the surrounding world.

However, the terminal 103 can be located at any location where it is advantageous to have such a terminal for providing access to cellular telephones where these in normal circumstances cannot be used, for example due to restrictions or due to lack of radio coverage. Thus, the terminal 103 can also be located on a train etc.

In the embodiment shown in Fig. 1, the terminal 103 supports the GSM standard, but other cellular standards can be supported. The system which the terminal 103 communicates with a satellite system, supports multi-channel terminals, such as the terminal 103 in FIG. 1. A multi-channel terminal provides multiple extensions and direct dialling to and from each individual extension.

Furthermore, each mobile station 107 can perform SIM (Subscriber Identity Module) based roaming in the network. Thus, using the GSM SIM card, each subscriber can receive calls directed to their home network number, be billed via their usual service provider for telephone services used on-board the aeroplane, and have access to the same functions as usual.

However, individual roaming traffic from each mobile station 107 will most likely create a problem of traffic overload in the satellite system, since many mobile stations will change location simultaneously. In order to solve this problem the terminal 103 has a function for performing simultaneous location update of all mobile stations attached to the terminal 103 using one single location update message for all mobile stations.

In Fig. 2, a flow chart illustrating the steps carried out in the system shown in Fig. 1, when performing a common location update for all mobile stations 107. Thus, first when a mobile station, in this example a GSM mobile station, is attached to a multi-channel terminal (MCT) 201, a message is transmitted to a HLR (Home Location Register) 203 of the satellite system via a Mobile Satellite Service Switching Center (MSSC) 205, as a message 231. The message comprises an identification of the MCT 201, for example a GSM International Mobile Subscriber Identity (IMSI) of the MCT 201, and the IMSI of the mobile station. The message 231 is then forwarded onwards to the HLR of the GSM mobile station (not shown).

The HLR 203 of the satellite system returns an acknowledgement message 233 to the MCT 201. This procedure is repeated for each mobile station 107, which is attached to the MCT 201, and the satellite system 101 stores the identity of each Mobile station 107 attached to the multi-channel terminal 201.

When the MCT 201, and hence all mobile stations attached to the terminal 201, change location and a location update is required, the following steps are performed. First, a message 235 is transmitted from the MCT comprising the IMSI of the MCT 201 to the MSSC 205, which in turn sends a location update to the HLR 203 of the satellite system in a message 237. The HLR of the satellite system then returns an acknowledgement message 239 to the MSSC, which sends a corresponding acknowledgement message 241 to the MCT 201.

Using the information from the MCT 201, i.e. the new location of the MCT 201 and which mobile stations that currently are connected to the MCT 201, the satellite system can implicitly derive the new location for all mobile stations connected to

the MCT 201 and thereby reduce the signalling traffic over the air-interface from the MCT 201.

Furthermore, in a preferred embodiment, the periodic updating is performed for the MCT 201 and is valid for all Mobile Stations 107 currently attached to the MCT 201. By means of performing the periodic update simultaneously for all Mobile Stations 107 attached to the MCT 201 using one single update message reduces the bandwidth requirements even further.

Using the system as described herein will significantly reduce the traffic load over the air-interface in a system providing mobile communication access using the subscribers usual cellular mobile station at location where such a mobile station normally cannot be used, such as on an aeroplane or onboard a train being outside the radio coverage area of the cellular system.

CLAIMS

1. A method of updating the location of a mobile station connected to a terminal, which terminal provides an interface between a multitude of mobile stations and a satellite communication system, **characterized by** the steps of:

- transmitting information comprising the identity of the terminal and of a particular mobile station to the satellite system each time a mobile station is attached to the terminal,
- storing in the satellite communication system the identities of each mobile station currently attached to the terminal, and
- transmitting a location update message from the terminal to the satellite system comprising the identity of the terminal when a location update is required, whereby the satellite system can perform a location update using the location update message from the terminal and the information of which mobile stations that currently are attached to the terminal.

2. A method according to claim 1, **characterized in** that a periodic update of the mobile stations is performed by means of transmitting a periodic update message from the terminal, which periodic update message is valid for all mobile stations currently attached to the terminal.

3. A method according to any of claims 1 or 2, when the terminal supports mobile stations according to the GSM standard, **characterized in** that the information transmitted from the terminal to the satellite system when a new mobile

station is attached to the terminal comprises an IMSI of the mobile station and an IMSI of the terminal.

4. An apparatus in a terminal for updating the location of a mobile station connected to the terminal, which terminal provides an interface between a multitude of mobile stations and a satellite communication system, **characterized by**:

- means for transmitting information comprising the identity of the terminal and of a particular mobile station to the satellite system each time a mobile station is attached to the terminal, and
- means for transmitting a location update message from the terminal to the satellite system comprising the identity of the terminal when a location update is required.

5. An apparatus according to claim 4, **characterized by** means for transmitting a periodic update of the mobile stations by means of transmitting a periodic update message from the terminal, which periodic update message is valid for all mobile stations currently attached to the terminal.

6. An apparatus according to any of claims 4 or 5, when the terminal supports mobile stations according to the GSM standard, **characterized by** means for transmitting an IMSI of the mobile station and an IMSI of the terminal to the satellite system.

ABSTRACT

In a method and an apparatus a subscriber to a cellular telephone entering an area with restricted use of cellular telephones attaches and registers the cellular telephone in a terminal located in the restricted area. The terminal provides a connection to a satellite system, for example the ICO satellite system. Each time a new subscriber connects to the terminal a location update message is transmitted to the satellite system. The information is stored in the satellite system until a subscriber leaves the area covered by the terminal. A message is then transmitted from the terminal to the satellite system informing the satellite system that the subscriber is no longer connected to the terminal and the subscriber is detached from the satellite system. When the terminal roams in the satellite network it will send a location update only comprising its own identity. The satellite network then implicitly updates the location of all cellular telephone subscribers registered in or attached to the terminal. Thereby significantly reducing the signalling caused by roaming.

(Fig. 2)

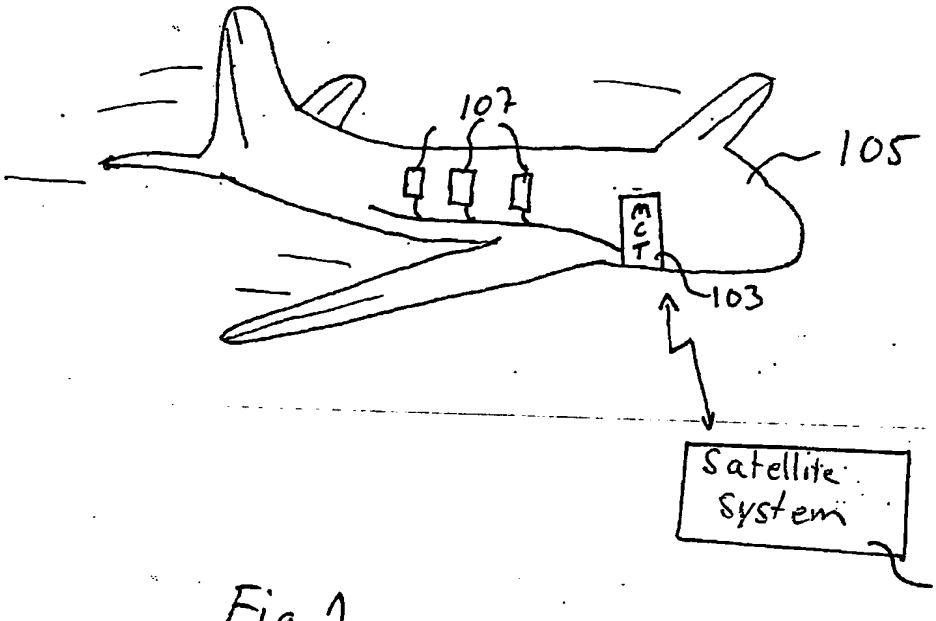

Fig. 1

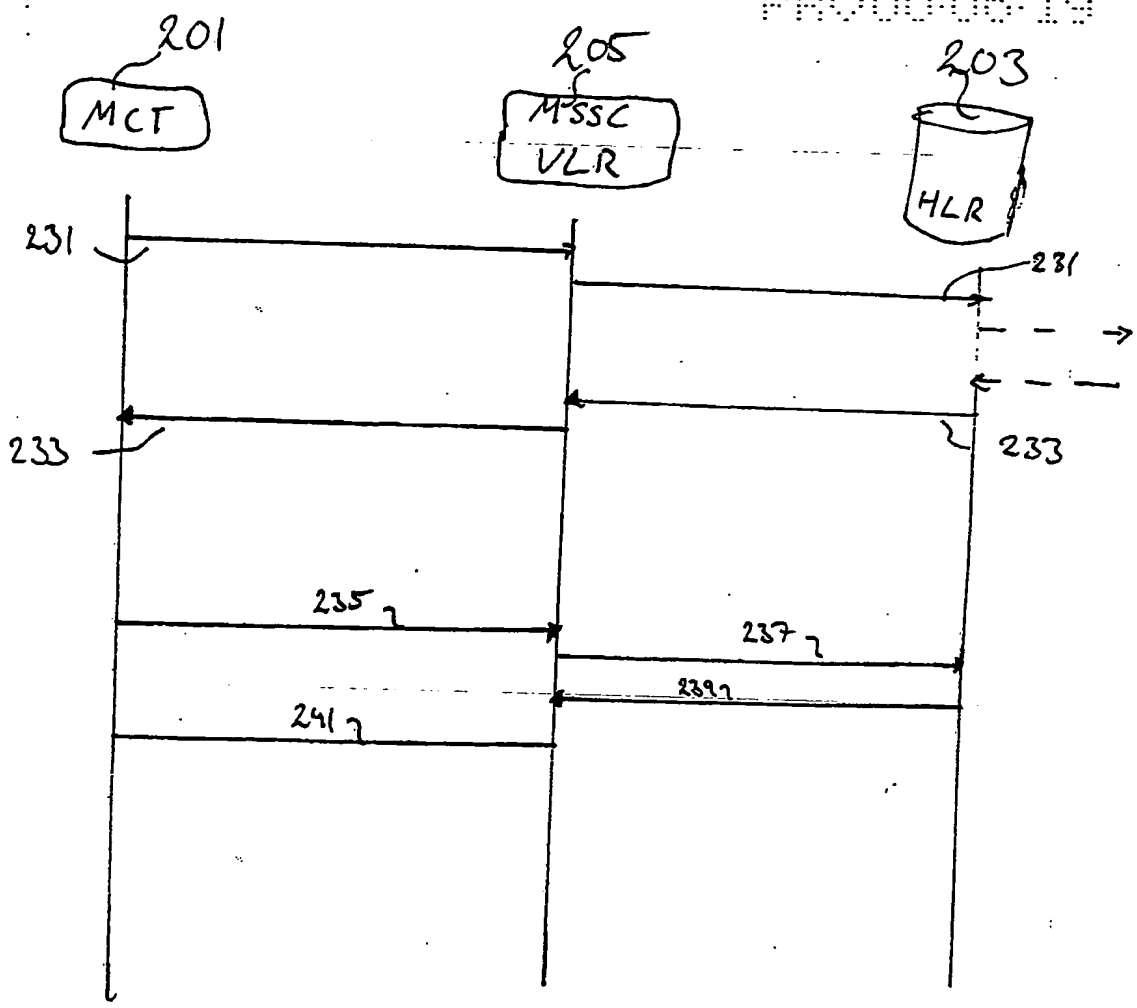

Fig. 2